

What is claimed is:

1. A direct pool cooling type passive safety grade decay heat removal method for a liquid metal reactor,

5 wherein the liquid level difference between a hot pool defined above a core and inside a reactor baffle and a cold pool defined between the reactor baffle and the inner wall of a reactor vessel is maintained by a primary pumping head under normal steady-state conditions, the interior of the
10 reactor vessel being partitioned into the hot pool and the cold pool by the reactor baffle,

15 wherein a sodium-sodium heat exchanger connected to a sodium-air heat exchanger mounted above a reactor building via a heat removing sodium loop is disposed at the position higher than a liquid level of the sodium in the cold pool under the normal steady-state conditions, and

20 wherein the liquid level of the sodium in the cold pool rises so that the liquid level difference between the hot pool and the cold pool is eliminated when the primary pump is automatically tripped due to a failure of a normal heat removal system, and the sodium in the hot pool is expanded due to core decay heat so that the sodium in the hot pool overflows into the cold pool to form natural circulation flow paths between the hot pool and the cold pool, whereby the
25 sodium-sodium heat exchanger makes direct contact with the

hot sodium so that the core decay heat is discharged into a final heat sink, the atmosphere.

2. The method as set forth in claim 1, wherein the
5 outer circumference of the reactor vessel is also cooled with external air by using a passive vessel cooling system.

3. The method as set forth in claim 1 or 2,
wherein at least one circular vertical tube is disposed
10 in the hot pool inside the reactor baffle, the circular vertical tube has the lower end communicating with the cold pool so that the sodium in the circular vertical tube has the same liquid level as the liquid level of the sodium in the cold pool, and the upper end extended upward to the extent
15 that it is placed at the position higher than a liquid level of the sodium in the hot pool under the normal steady-state conditions,

wherein the sodium-sodium heat exchanger is disposed in the circular vertical tube while it is placed at the position higher than the liquid level of the sodium in the cold pool under the normal steady-state conditions, and

wherein heat transfer only by thermal radiation is performed between the inner circumference of the circular vertical tube and the sodium-sodium heat exchanger under the
25 normal steady-state conditions so that solidification of the

sodium in the heat removing sodium loop is prevented.

4. The method as set forth in claim 3, wherein the core decay heat is removed by the combination of the heat removing sodium loop and the sodium-air heat exchanger on the basis of a completely passive concept without the provision of dampers disposed in an air inlet and an air outlet of the sodium-air heat exchanger and isolation valves mounted in the heat removing sodium loop.

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5. The method as set forth in claim 3, wherein the heat transfer by thermal radiation is quantitatively controlled by manipulating surface emissivity of the sodium-sodium heat exchanger and the circular vertical tube to minimize heat loss under the normal steady-state conditions so that the minimum amount of heat necessary to prevent solidification of the sodium is supplied to the heat removing sodium loop.

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6. A direct pool cooling type passive safety grade decay heat removal system for a liquid metal reactor comprising a reactor vessel having the interior partitioned into a hot pool and a cold pool by a cylindrical reactor baffle, the hot pool being defined above a core and inside the reactor baffle, the cold pool being defined between the reactor baffle and the inner wall of the reactor vessel,

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liquid level difference between the hot pool and the cold pool being maintained by a primary pumping head under normal steady-state conditions, wherein the decay heat removal system for removing core decay heat when a normal heat removal system breaks down comprises:

at least one sodium-sodium heat exchanger disposed in the cold pool while being placed at the position higher than a liquid level of the sodium in the cold pool under the normal steady-state conditions so that the heat transfer only by thermal radiation is performed under the normal steady-state conditions;

at least one sodium-air heat exchanger mounted above a reactor building; and

the heat removing sodium loop connected between the sodium-sodium heat exchanger and the sodium-air heat exchanger.

7. The system as set forth in claim 6, further comprising at least one circular vertical tube disposed at the edge of the hot pool inside the reactor baffle, the circular vertical tube having the lower end communicating with the cold pool so that the liquid sodium level inside the circular vertical tube is maintained with the same level of the sodium in the cold pool, and the upper end disposed at the position higher than a liquid level of the sodium in the

hot pool, wherein the sodium-sodium heat exchanger is disposed inside the circular vertical tube while it is placed at the position higher than the liquid level of the sodium in the cold pool under the normal steady-state conditions.

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8. The system as set forth in claim 6 or 7, wherein the sodium-air heat exchanger is not provided at an air inlet and an air outlet thereof with dampers, and the heat removing sodium loop is not provided with isolation valves.

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